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MAXIMIZING THE VALUE OF INFORMATION TECHNOLOGY INVESTMENT BASED ON STRATEGIC ALIGNMENT, RISK CONTROL AND REAL OPTIONS: A CASE STUDY OF ENTERPRISE SYSTEM IMPLEMENTATION AT PT PEGADAIAN (PERSERO)

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Abstract—*the world of IT market has experienced fast growth by 9.7% worth US$ 527.9 billion (Rp 5.015,1 trillion) in 1995, but still IT value realization is questioned with the advent of IT Productivity Paradox phenomenon. In 2002, Gartner survey stated that 20 to 70% IT investment worth US$ 600 billion (Rp 6,315.8 trillion) was wasted. However, the phenomenon was fading with the rise of IT governance and management field, including IT investment management best-practice. Latest research from PwC and ITGI in 2011 has shown that the practice brought 27.1% increased value and 28.1% improved business competitiveness. Recently, PT. Pegadaian (Persero) has planned to invest on a new centralized real-time online Enterprise System. Considering this is a large scale IT investment which estimated TCO is around Rp 1.1 trillion (16% of Total Gross Revenue and 1100% of Total Investment in 2011), while the world historical data has shown many of its failures, in fact Pegadaian itself has experienced ES implementation failure in 2009-2011 which has wasted significant resources, therefore the management is very concerned about how to prevent project failures while maximizing the value from it. The author has proposed the combination use of strategic alignment, risk control and real options valuation methods which enhanced the conventional investment analysis methods such as IRR, NPV, ROI and Payback Period to solve Pegadaian's problem. This paper result showed that the combination of those methods has maximized the value of IT investment by making sure that the investment is aligned with business objectives, able to control its risks and offered managerial flexibility through viable investment option configurations which maximizing the value.*

Keywords: IT investment, strategic alignment, risk, real options, enterprise systems, IT governance and management

I. INTRODUCTION

A. Background

Although the world of IT market has experienced fast growth by 9.7% worth US$ 527.9 billion (Rp 5.015,1 trillion) in 1995 (OECD, 1997: 13, 17-18), but still IT value realization is questioned with the advent of IT Productivity Paradox phenomenon which stated by Robert Solow (Brynjolfsson, 1993). It is the failure of IT investment value realization in term of productivity, for example ERP failure which stated by Trunick in Chen that the study indicates 40% partial failure; even 20% are total failures. Schragenheim also stated 60 to 90% IT investment cannot achieve the promised return of investment (Chen, 2001: 374).

Furthermore, in 2002, Gartner survey stated that 20 to 70% IT investment worth US$ 600 billion (Rp 6,315.8 trillion) was wasted. In addition, in 2004, IBM survey showed that Fortune 1000 CIOs believe 40% their IT spending brought no return (ITGI, 2008: 7)

However, the phenomenon was fading as the rise of IT governance and management field, including IT investment management best-practice. Latest research from PwC and ITGI in 2011 has shown that the practice brought 27.1%

increased value and 28.1% improved business competitiveness (ISACA, 2012: 39).

B. Company Profile

According to Pegadaian Annual Report 2011 (Pegadaian, 2012d), Pegadaian's vision in 2013 is becoming champion for micro-small credit based on pawn and fiduciaries. Its mission is contribution in society's welfare, GCG and use optimum resources. Its motto: "to solve problems without problems," and its SLA is "maximum 15 minutes to transact."

Pegadaian's gross revenue in 2011 is Rp 6.6 trillion (US$ 627 billion) which came from Core Business: conventional and sharia pawn totally 82.9% and Non-core Business: fiduciary small-microfinance, gold and other business totally 17.1%. It's revenue has growth around 16-37% this 5 years consecutively and Pefindo credit rating is AA+ (stable outlook).

In 2011, Pegadaian has 1 Head Office, 12 Regional Offices, 897 Main Branch Offices, 3,988 Conventional Outlets, 598 Sharia Outlets. It has 24,277 employees: 33.5% permanent and 66.5% temporary. While in IT functional: 1 GM, 3 Managers, 22 Staffs HO and 2 Staffs for every RO.

Recently, PT. Pegadaian (Persero) has planned to invest on a new centralized real-time online Enterprise System. Considering this is a large scale IT investment which estimated TCO is around Rp 1.1 trillion (16% of Total Gross Revenue and 1100% of Total Investment in 2011), while world historical data has mentioned many of its failures, in fact Pegadaian itself has experienced ES implementation failure in 2009-2011 which has wasted significant resources.

According to IT auditor report (PT. LAPI ITB, 2012) the main points of this failure are: the vendor is lacking business process understanding, lacking solution development capability to implement proposed solution, bad communication between vendor and owner and inadequate quality and project management practice.

Therefore the management is very concerned about how to prevent project failures while maximizing the investment value. The research objective is to formulate a framework and propose recommendation to solve Pegadaian's problem.

II. THEORETICAL BACKGROUND

According to Wheelen (Wheelen and Hunger, 2012) strategic management will sustain long-term organizational performance. Strategic alignment itself is a part of strategic management process by cascading the corporate strategies into functional strategies, including IT (Kaplan and Norton 1996). IT strategic alignment as part of IT governance & management practice has contributed to IT value improvement (ISACA,2012).

IT investment, just like in any other fields, should pass the hurdle rate for management to decide yes, as any investment of course should have a return to be realized. But in other side IT benefit is naturally hard to quantify while the cost usually feel relative expensive. It is related to IT productivity phenomenon which previously mentioned. Therefore, conventional investment analysis such as NPV, IRR, ROI and Payback Period that able to identify and calculate the intangible benefit in financial term will be very useful in IT investment valuation (Murphy, 2002).

All organization activities always involve risks. Ability to understand the context, identify the risks, analyze it and evaluate it whether should be mitigated or left as residue is important factor in realizing value (ISO 31000), including in IT investment. Benaroch has identified generic risk factors for IT investment which divide into 2 parts, internal/ firm-specific and external risks which distributed to every investment lifecycle stage such as inception, recognition, building, operation, retirement and obsoleteness (Benaroch, 2001).

Pioneered by Myers in 1977, real options theory is derived from Black-scholes and Binomial methods. It is a right, not obligation, to undertake certain business initiatives such as deferring, expanding, staging, contracting an investment project, including IT. Its value is a direct function of ability to mitigate risks using available options. Brach (Brach, 2003) has showed the real options formula as follows and its parameters are described in Table 1.

Real options implementation offered managerial flexibility to choose viable options to mitigate the previously mentioned IT investment risks.

III. ANALYSIS

A. Method of Data Collection and Analysis

The author is proposed the use of strategic alignment, conventional investment, risk and enhanced investment analysis based on real options to mitigate the risk of failure while maximizing the IT investment value. The proposed framework as illustrated in Figure 1 is derived from OBRIM framework (Benaroch, 2007).

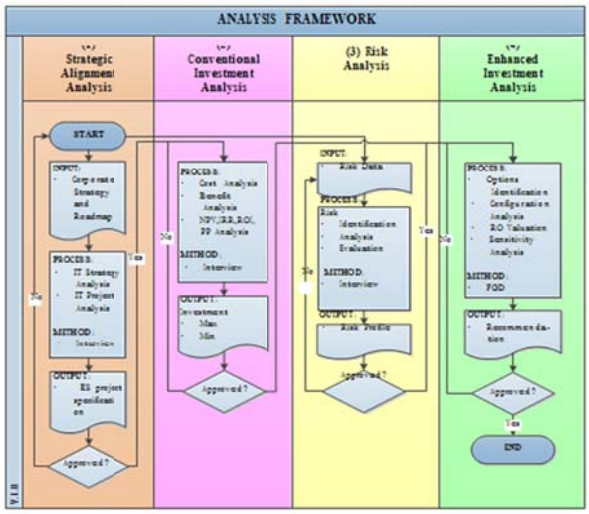


Figure 1. Analysis Framework (modified from OBRIM)

Data collection is using methods as follows:

1. Interview:
   a. Objectives: to obtain information about Pegadaian's existing strategy, IT condition and risk data.
   b. Interviewees: internal auditors; business management (business GM, head of RO, head of MBO, head of outlets, supervisors); IT management (IT GM, IT managers); business employees (appraisers, cashiers, operators); IT employees (analyst, programmers, help-desk, technician).
2. FGD (Focus Group Discussion):
   a. Objectives: to discuss about the analysis framework and its result.
   b. Group member: top level management (CEO, CFO, COO, CHRO and CBDO) and business and IT management representatives.

The rest of data are collected as primary and secondary data from related-references such as journals, theses, books, Pegadaian's documents and websites.

The analysis is performed as follows:

1. Strategic Alignment Analysis:
   a. Input: corporate strategy and roadmap;
   b. Process:
      i. IT Strategy Analysis: to cascade Pegadaian's corporate strategy into IT strategy and initiatives.
      ii. Project Analysis: to compose ES project specification.
   c. Outputs: ES project specification which consists of application, IT infrastructure and IT governance and management projects.

2. Conventional Investment Analysis:
   a. Input: ES project specification;
   b. Process:
      i. Cost Analysis: to identify the cost structure of ES project and then calculate it;
      ii. Benefit Analysis: to identify the benefit structure of ES project and then calculate it;
      iii. Investment Analysis: to calculate the minimum and maximum condition of ES project using NPV, IRR, ROI and PP.
   c. Outputs: minimum and maximum condition of ES project.

3. Risk Analysis:
   a. Input: risk data;
   b. Process:
      i. Risk Identification: to identify the risk factors of ES project;
      ii. Risk Analysis: to analyze the probability and impact and then assess the level of risks;
      iii. Risk Evaluation: to prioritized the previously analyzed risks;
      c. Outputs: investment risk profile.

4. Enhanced Investment Analysis:
   a. Input: minimum and maximum conventional investment project and investment risk profile;
   b. Process:
      i. Risk-based options identification: to identify risk-based viable options;

ii. Configuration analysis: to design option configurations using different subsets;
iii. Real Options valuation: to assess the expanded project value for the configuration.
iv. Sensitivity analysis: to test the robustness of valuation result;

c. Outputs: favorable options configuration.

B. Research Finding

Strategic Alignment Analysis

First, IT Strategy Analysis is performed. Pegadaian's 9 corporate strategy and roadmap are described in Pegadaian Roadmap 2012-2015 (Pegadaian, 2012: 127). This strategy has been cascaded into IT strategy which resulting 9 IT strategy as follows:

1. Efficiency improvement in business process management and implementation;
2. Optimization in the creation of new products, new customers and new opportunities;
3. IT service quality improvement;
4. Increase customer (user) satisfaction;
5. Improve the quality of IT development;
6. Improve the quality of IT operation;
7. Improve the quality of IT governance implementation;
8. Increase IT human resource competency; and
9. Increase utilization of information assets for internal collaboration in companies.

Then, based on TOGAF 9.1 (The Open Group, 2011) and Pegadaian's Business Requirement (Pegadaian, 2012a) which contained business process reengineering result, IT initiatives on IT architecture which consists of Application and IT Infrastructure as illustrated in Figure 2.

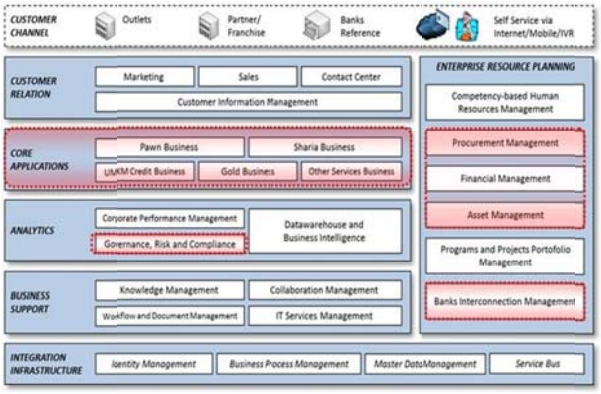


Figure 2. Pegadaian's Application Architecture

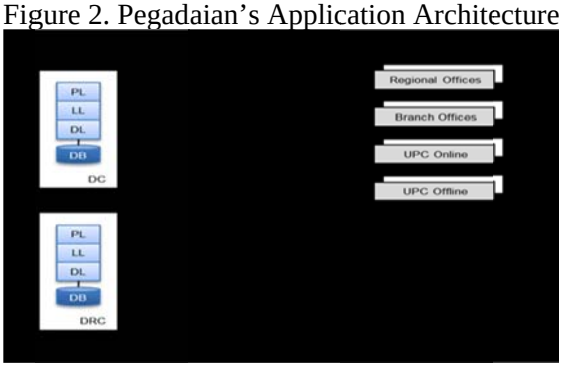
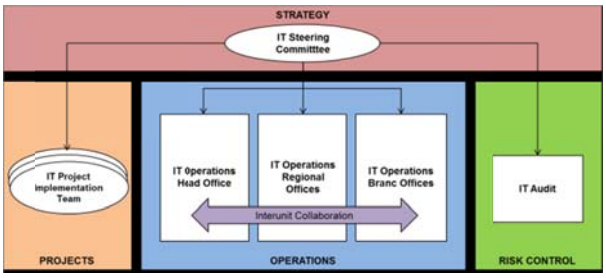


Figure 3. Pegadaian's IT Infrastructure Architecture

To prepare for higher load of future IT implementation and operations, IT initiative on IT Governance & Management based on COBIT 5(ISACA, 2012) has been formulated. Pegadaian's required IT organization restructuring as illustrated in Figure 4.



Second, IT Project Analysis is performed to compose the ES project specification which resulting as follows:

1. Core Application implementation which covering all of Pegadaian's line of business which are: pawn business, sharia business, small-micro credits, gold business and other services to improve productivity and deliver better quality services.
2. Some of ERP Applications which are:
   a. Budgeting Application to support better distribution of company financial resources.
   b. Treasury Application to support better control of financial-related risk.
   c. Accounting Application to deliver accurate and timely financial reporting.
   d. Asset Management Application to monitor and maintain company assets.
3. Some of Analytics Applications which is Internal Audit Application to improve quality supervision and monitor GCG conformance.

4. Centralized IT infrastructure to support online and real- time processing of Application mentioned above, which consists of:
   a. DC (Data Center) to support centralized application processing, including application and database server.
   b. DRC (Disaster Recovery Center) to support Pegadaian's business continuity when DC down.
   c. WAN (Wide Area Network) as Corporate Intranet to provide online environment which consists of Private WAN and VPN Internet.

5. Restructuring Pegadaian's organization to provide adequate IT leadership, structure and processes (IT Governance) by executing these initiatives:

a. Forming IT Strategy Committee to facilitate better IT strategic decision making.
b. Expanding IT Structure to provide better SOD (Segregation of Duties) which preventing fraud and errors.
c. Adding IT investigator position for fraud examination and IT auditor for evaluating IT controls, both to better control of IT risks.

Conventional Investment Analysis

First, Cost Analysis has been launched.The cost structure has been identified and mainly there are 3 categories which are application cost, IT infrastructure costs which consists of CAPEX for preparing Development, DC andDRC environments and OPEX for providing the WAN Selindo, and the last is change management cost. The total cost consists of Rp 111 to 138 billion for CAPEX in 5 years lifetime, Rp 32 to 51 billion for one-time OPEX and the last is Rp 127 to 131 billion for yearly OPEX. The TCO is calculated Rp 1.1 trillion which worth 16% of Total Gross Revenue and 1100% of Total Investment in 2011.

Second, Benefit Analysis has been performed. The benefit structure consists of 3 main sources which are cost reduction and avoidance came from employee, business trips, paperless and Internet cost avoidance, losses reduction from utilizing the new ES and available time of auditors, and then the last is increase revenues came from existing business growth and new business such as remittance and payment gateway. The total benefit consists of Rp 48 to 72 billion from cost reduction & avoidance, Rp 40 to 60 billion from losses reduction and the last is Rp 160 to 274 billion from increasing revenues with growth rate 16 to 37%.

Third, Conventional Investment Analysis is delivered. The first step is to count the cost from Rp 4 trillion long-term bonds and notes which resulting 9.38% COD. Then, the cost from Rp 4 trillion capital and retain earnings which resulting 19.92% COE. So, the WACC is 14.75%. The conventional investment analysis for seven years (2012-2018) is provided in 2 forms: minimum and maximum condition. The minimum condition resulting IRR 15.7%, NPV Rp 6.4 billion, ROI 0.83% and Payback Period in 6 years, while the maximum condition resulting IRR 123.9%, NPV Rp 1.05 trillion, ROI 149.6% and Payback Period 3 years 2 months. The average NPV, IRR and ROI are Rp 529 billion, 69.8% and 75.2%. According to the survey (CIO Magazine, 2006) the ROI for IT investment industry standard is 28%, which is passed by this project.

Risk Analysis

First, Risk Identification is performed. There are totally 26 risk factors which categorized into internal and external risk.

Internal risk which consists of:

1. Monetary: 1) project funding, 2) budget accuracy, 3) benefit accuracy, 4) budget disbursement;
2. Organizational: 5) project alignment, 6) procurement process, 7) management support and leadership, 8) change management;
3. Functional: 9) business complexity, 10) design incompatibility;
4. Project: 11) project complexity, 12) plan clarity, 13) team skill and experience, 14) architectural stability, 15) project monitoring and quality assurance, 16) project documentation.

External risks which consists of:
1. Industrial: 17) competitive rivalry, 18) over demand, 19) under demand;
2. Political: 20) regulatory change, 21) leadership change;
3. Economic: 22) exchange rate, 23) economic crisis;

4. Technological: 24) technology capability, 25) technology obsolescence; and
5. Environmental: 26) disaster.

Second, Risk Analysis is launched. Probability analysis resulting 6 high, 7 medium and 13 low probability, while impact resulting 15 major, 10 moderate and 1 minor impact.

Third, Risk Evaluation is done. The result of risk evaluation is mapped into relevant 3x3 matrixes in Table 2.

Table 2. Risk Evaluation Matrix

Impact / Probability	Minor	Moderate	Mayor
High	N/A	17, 18, 21	9, 11, 20
Medium	N/A	25	4, 6, 8, 10, 13, 16
Low	19	2, 3, 22, 23, 24, 26	1, 5, 7, 12, 14, 15

Enhanced Investment Analysis

Table 3. Example Risk-based Options Identification

Risk Analysis			Options Analysis								
			Recogniti	Building					Operation		
No	Risk Factor	Quadrant	1. Defer	2. Pilot	3. Proto-type	4. Stage	5. Lease	6 Out-source	7. Aban-don	8. Con-tract	9. Expa
9	Business Complexity	I	* [21	* [8]	* [8, 13]	* [13	-	-	*	* [4, 13]	-
11	Project Complexity	I	-	* [8, 10, 13, 17, 20]	* [8, 10, 13, 17, 20]	* [4, 13, 22]	* [27	* [28	*	* [4, 13, 17, 19, 26]	-
20	Regulatory Change	I	* [8, 21]	-	-	-	* [30	*	* [7]	*	*
4	Budget Disbursement	II	*	*	*	*	-	-	-	-	-
6	Procurement Process	II	*	*	*	*	-	-	-	-	-
8	Change Management	II	* [30	* [2, 17, 24]	*	* [1, 2, 17, 20, 21]	* [27	*	* [5]	* [30	*

First, Risk-based Options Identification is performed by mapping the previously evaluated risks into 9 available Real Options to control it which are defer (recognition stage); pilot, prototype, stage, lease and outsource (building stage); and then abandon, contract and expand (operation stage) as presented in Table 3. Then, the options success probability is calculated based on the map mentioned which resulting 0.91 for defer, pilot and prototype options, 0.79 for stage option, 0.67 for lease and outsource options, 0.87 for abandon and contract options, and then 0.74 for expand option.

Second, Option Configurations Analysis is performed based on last result. Option defer, prototype, lease, outsource and contract are ruled out because of incompatibility. So, the configurations are constructed based on of pilot, stage, abandon and expand options. There are 6 scenarios developed which are
1) pilot + abandon; 2) stage-1 + abandon; 3) pilot + follow-up;
4) stage-1 + stage-2; 5) pilot + follow-up + expand; and 6) stage-1 + stage-2 + expand.

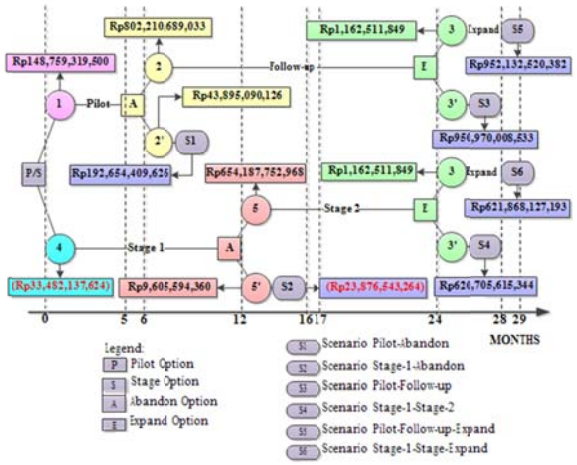


Figure 5. Option Configurations Valuation

Third, Real Options Valuation and Sensitivity Analysis have been performed for every viable option. Conventional investment analysis in minimum and maximum condition for every option are performed which resulting conventional NPV average for 1) pilot is Rp 64.3 billion; 2) abandon-pilot is Rp 47.7 billion; 3) follow-up is Rp 538.1 billion; 4) stage-1 is (Rp 24,9 billion); 5) abandon-stage-1 is (Rp 24.9 billion); 6) stage-2 is Rp 449,8 billion, and then 7) expand is Rp 1.7 billion.

Then, Real Options valuation and sensitivity analysis is performed for every viable option. The Real Options valuation are resulting as follows: 1) pilot is Rp 148.8 billion; 2) abandon-pilot is Rp 43.9 billion; 3) follow-up is Rp 802.2 billion; 4) stage-1 is (Rp 33.5 billion); 5) abandon-stage-1 is Rp 9.6 billion; 6) stage-2 is Rp 654.2 billion; 7) expand is Rp 1.2 billion as illustrated in Figure 5 while the sensitivity analysis example for pilot option is illustrated in Figure 6.

It can be inferred that favorable option configuration is Scenario 5: Pilot + Follow-up + Expand resulting value Rp 952.1 billion compared to conventional result Rp 529.1 billion and the very sensitive parameter is q (options success

probability) and Vmax (NPV in maximum condition).

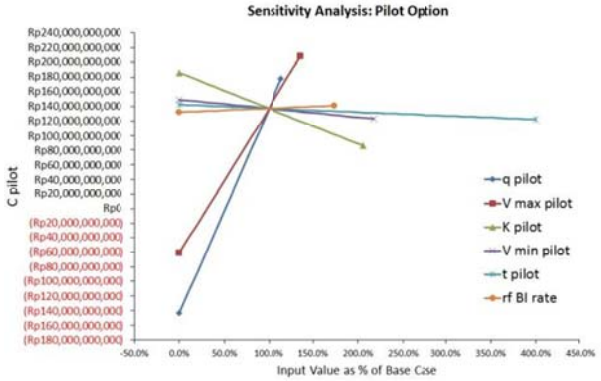


Figure 6. Example Sensitivity Analysis: Pilot Option

Discussion

After completing all of previous analysis mentioned, it can be inferred that strategic alignment, risk control practice and managerial flexibility in option configuration (Real Options) have contributed in maximizing the value of the IT investment. The step comparison is presented in Table 4.

Table 4. Contribution Difference on Value Maximizing

Step	Contribution Difference on Value Maximizing
1	Increase the possibility of IT value existence by composing the right IT investment to support business objectives achievement
2	Provide IT value range from minimum condition by maximize cost and minimize benefit to maximum condition by minimize cost and maximize benefit
3	Assess the risks which could prevent IT value realization in every investment stage, both internally and externally
4	Directly mitigate the previously assessed risks using viable options so the IT value is expanded more accurately within previously provided IT value range

Based on the finding, it is recommended for PT. Pegadaian (Persero) to execute this Enterprise System investment project using this configuration: Pilot + Follow-up + Expand projects which the present value amounting Rp 952.1 billion.

Pilot project should be performed in 6 months by implementing pilot application, development and DC environment, WAN infrastructure for HO and nearest location RO (Jakarta I and II). It is a quick win approach to increase change success probability by delivering usable and stable part of Enterprise System (pawn and accounting system) to get people awareness, buy-in and ownership to the project. Why Jakarta? It will minimize the technical failure risk because logically the further the distance from DC the bigger the risk, and then will avoid transportation and accommodation cost and will be easier to operate, maintain and control.

Then, follow up project should be performed in 18 months by implementing follow-up application, DRC environment and the follow-up WAN infrastructure for the rest 10 ROs.

Afterward, it should be followed by expand project which performed in 6 months by implementing audit application to enhance the ES value to suppress the fraud which reached approximately Rp 80 billion yearly (SPI Pegadaian, 2012)

IV. CONCLUSIONS AND RECOMMENDATION

After performing this research, it can be concluded that all 4 steps have contributed to maximize the IT investment value with key points as follows:

1. Strategic alignment analysis has increased the possibility of IT value existence by composing the right IT investment to support business objectives achievement.

2. Conventional investment analysis has provided IT value range from minimum to maximum condition.

3. Risk analysis has assessed the investment risks which could prevent IT value realization.

4. Enhanced investment analysis has mitigated the risks using viable options so the IT value is expanded more accurately within previously provided IT value range.

5. This framework can be applied to other real assets investment valuation other than IT by modifying the strategic alignment analysis into suitable one.

In order to increase IT value realization in future research, it recommended to analyze the contribution of KPI in developing, operating and maintaining the ES along its lifetime

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